



Nutrient Credit Trading Opportunities in Maryland

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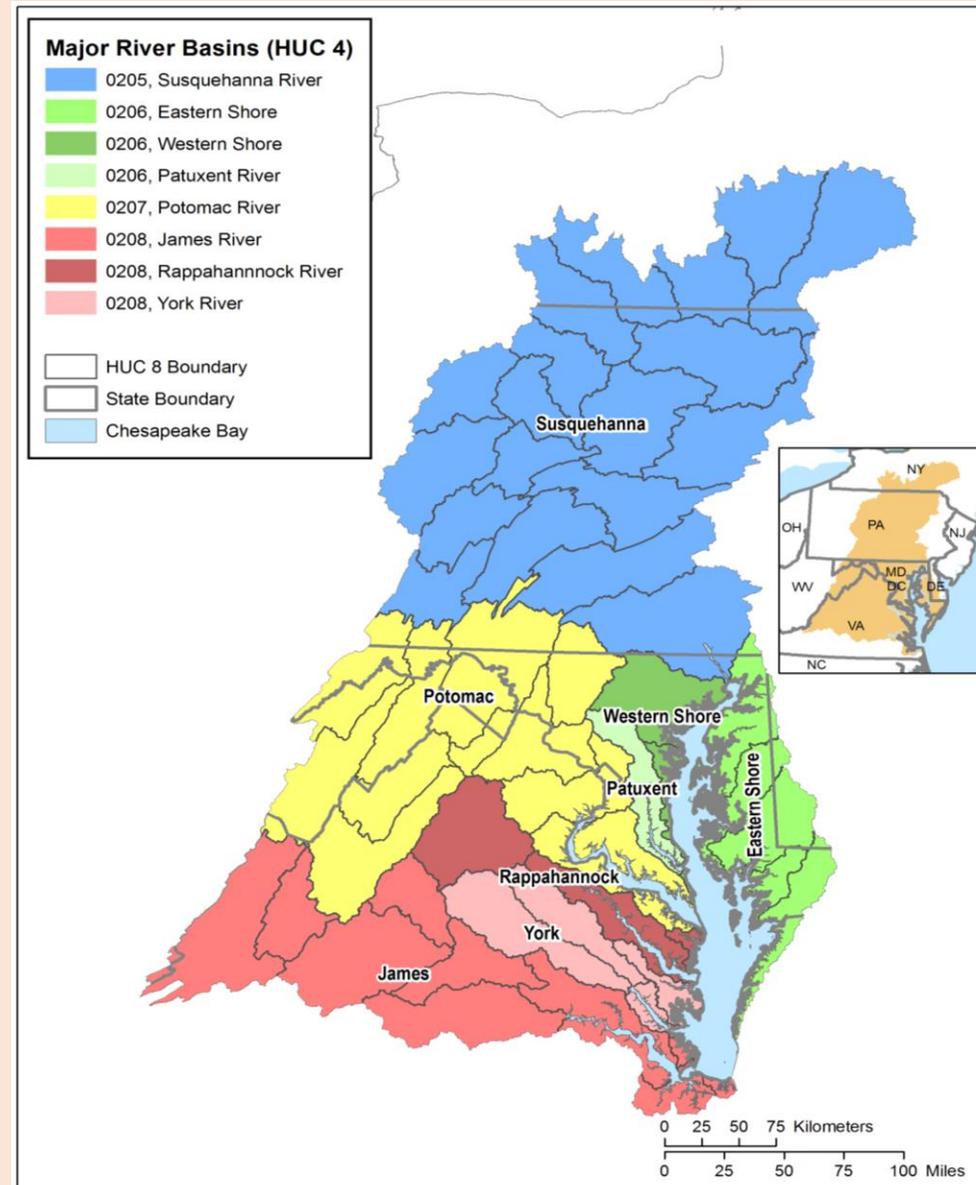
University of Maryland Center for Environmental Science

Chesapeake Biological Lab

Agricultural and Environmental Law Conference

11/14/19

Cap and Trade in the Chesapeake Bay watershed



Chesapeake Bay Total Maximum Daily Load (TMDL) or *pollution diet*

- Goal: restore *aquatic habitat* in estuary
- Cap: Roughly 20-25% reduction in nitrogen, phosphorus & sediment from 2010 loads

How might trading work?

INDUSTRY

High costs

Power plants, industrial factories, wastewater treatment plants can buy credits

FARM

Low costs

Farmers use money from credits for projects to reduce nutrient runoff



Trading is a bit different in Maryland

- Major WWTPs are a type of credit *seller* not buyer
 - Major wastewater treatment plants (WWTPs) have been upgraded with user fees (Bay Restoration Fund)
 - Have capacity to do additional management to reduce emissions below permitted emission levels
- Buyers are industrial dischargers, stormwater permit-holders and some minor WWTPs
- Sellers are those who *voluntarily* reduce nutrients using an approved practice and who otherwise meet all regulatory or baseline requirements

How legal & other risks affect trading market

- Trading between regulated and unregulated parties creates novel risks
 - Buyer concern - Legal liability for pollution reduction does not transfer
 - Sellers concern - Risk exposure via credit verification activities
 - Actions to generate credits cannot be used to comply with regulations affecting seller
- Legal liability for buyers is managed with specialized contracts (bi-lateral trades), by aggregators who offer pooled credits, and state reserve pool
- Cost savings or earnings must compensate buyers and sellers for taking risks – *risk premium*

How does trading lower costs of Bay restoration?

Total Costs
with Trading

Total Costs
without Trading



Pay those with low costs of reductions to offset high cost reductions



Median Annualized Costs of Practices in Use

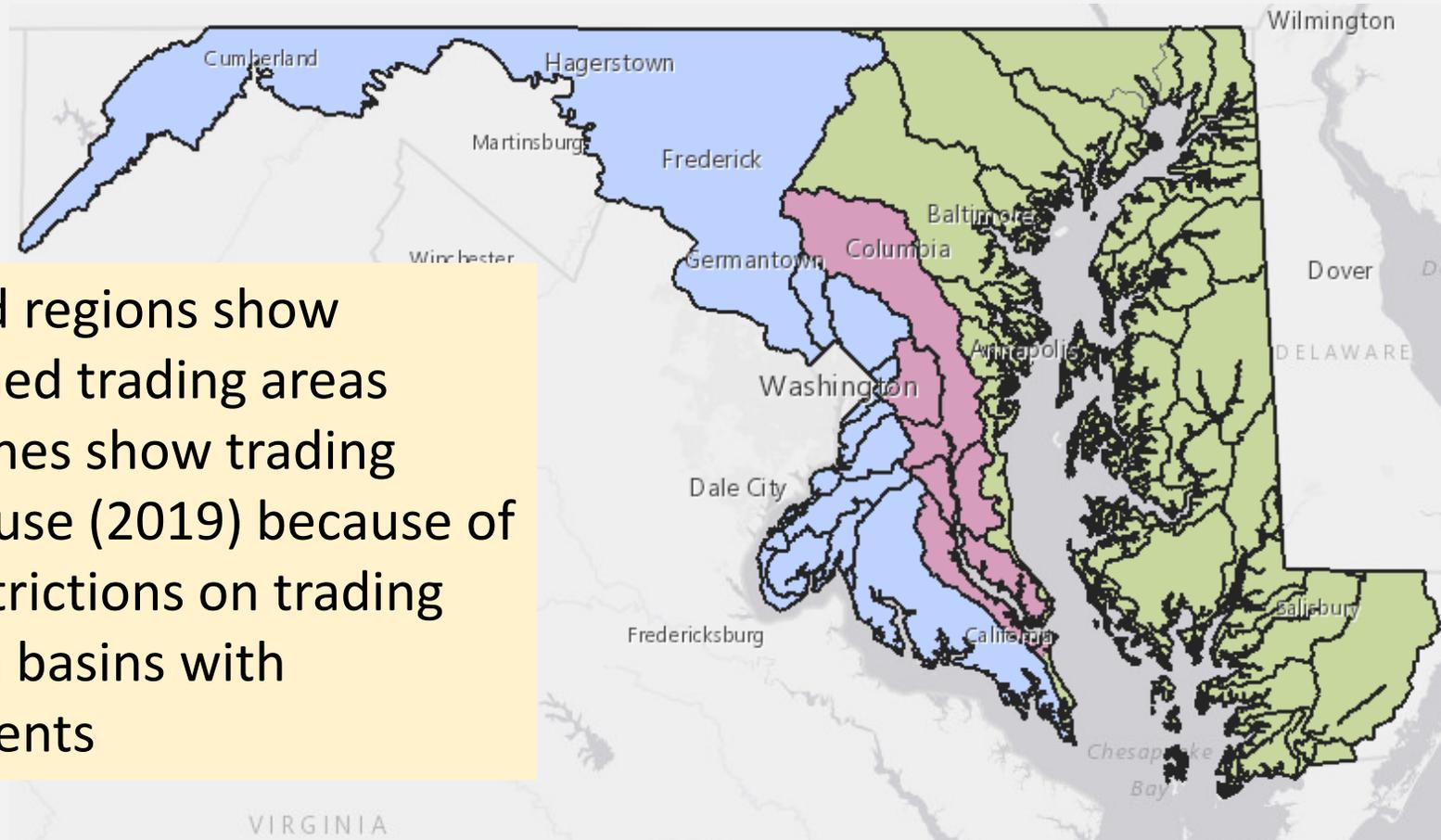
	Median \$/lb of N reduction	Median \$/lb of P reduction
Stormwater BMPs (excluding storm drain cleaning and practices n<3)	\$1,082	\$8,384
Agricultural BMPs	\$16	\$489

Data from Price et al. 2019. Cost Analysis of Stormwater and Agricultural Practices for Reducing Nitrogen and Phosphorus Runoff in Maryland.

Market price of credits is uncertain

Price depends on supply and demand by trading area

- Colored regions show established trading areas
- Black lines show trading areas in use (2019) because of legal restrictions on trading between basins with impairments



Credit Generation in Aquaculture

Credit Generation in Aquaculture



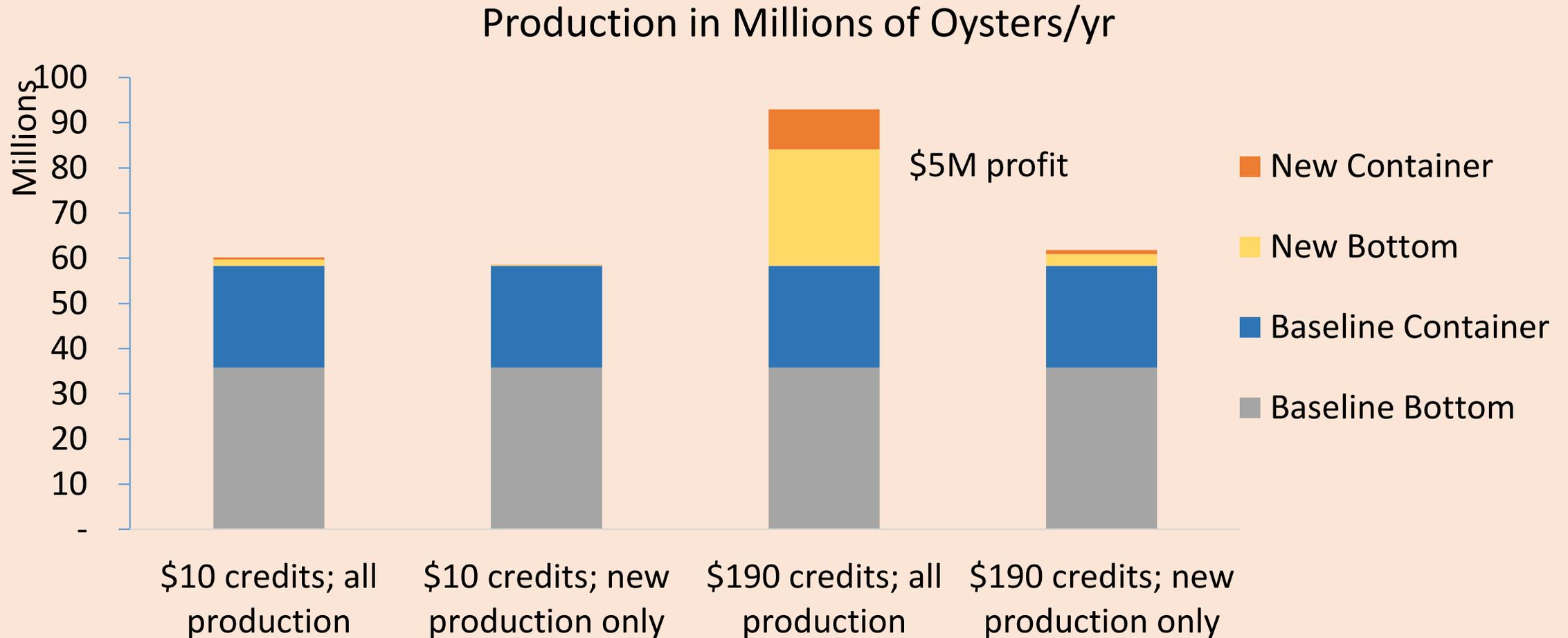
How Oyster Aquaculture Earns Nutrient Credits (example)

Oyster size and ploidy	N content (g/oyster)	P content (g/oyster)
2.5 – 3.49” diploid	0.09	0.01
2.5 – 3.49” triploid	0.13	0.01



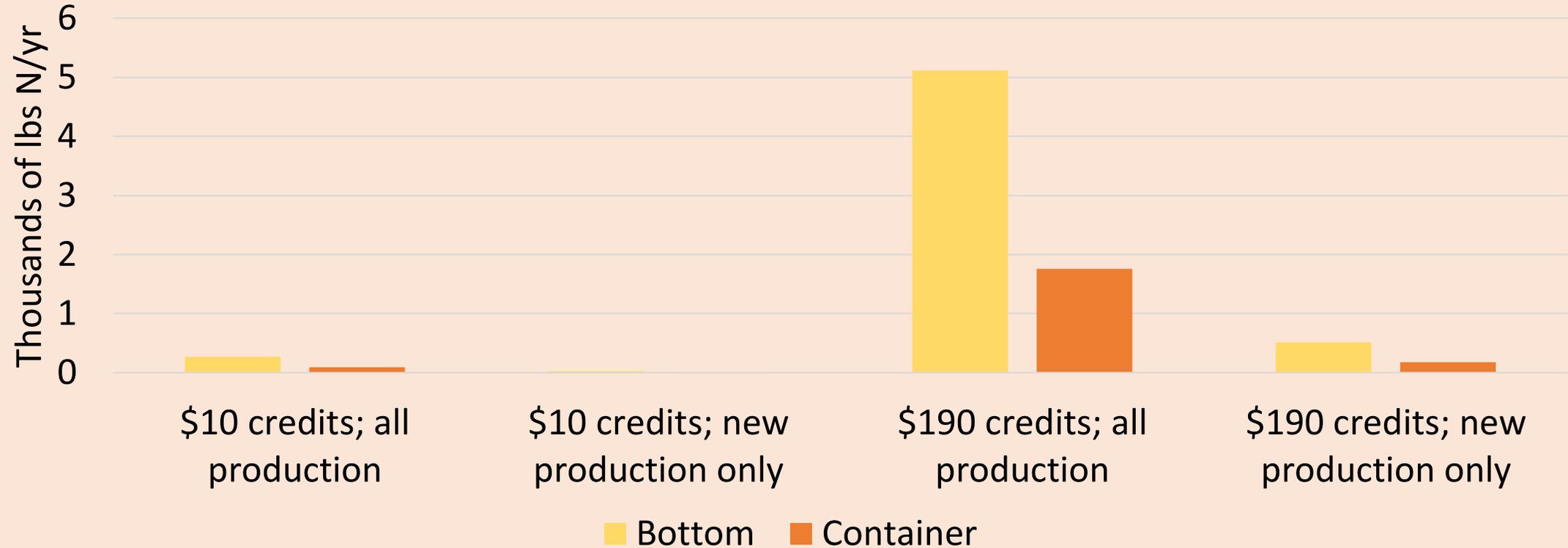
- Example operation
 - Diploid oysters harvested: 10,000 bushels
 - Average count per bushel: 275 ~~132~~ oysters
 - Average shell height: 3.33 inches
 - **247 kg N removed (545 lbs N)**
 - **27 kg P removed (60 lbs P)**

Trading has the potential to increase oyster aquaculture production



Aquaculture Growth Would Create Extra Nitrogen Reductions

Nitrogen Sequestered by Scenario



Results of Aquaculture Industry Modeling

- If nitrogen credit prices are sufficiently high and all production is eligible for trading, oyster aquaculture could be encouraged to grow more quickly than current trends
- Stacking nitrogen and phosphorus credits (as allowed in current policy) magnifies this effect
- Results are dependent on the assumption that higher profits will drive industry growth

Conclusions on Water Quality Trading in Maryland

- Trading can lower costs of achieving the nutrient and sediment cap to restore the Bay
- Credit buyers are those with high costs or other impediments to permit compliance
- Credit prices will have a large range statewide due to supply and demand conditions per geographic market region
- Prices will need to include a *risk premium* to address legal/other concerns
- Potential financial gains are motivating participation in MD's credit market

